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Current Characteristics and Shoreline Change at Pondok-Bali, North Coast-West Java of Indonesia

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Abstract

Numerical model of shoreline change by GENESIS (Generalized Model for Simulating Shoreline Change) and some field surveys were performed in the Pondok-bali Subang Distric of Indonesia. The objective of this investigation is to learn the cause of shoreline retreat that happen in Pondok-bali and its surrounding area in ten years nowadays. Based on field observation and the study result, we found that the waves occurred in East-wind monsoon, rip current and inundation due to water level raised have the significant contribution on an impact to shoreline retreat in Pondok -Bali.

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Keywords: :GENESIS; rip current; field survey; shoreline retreat; sediment transport

1. Introduction

Pondok-bali beach were face seriously erosion and shoreline retreat since 10 years ago, This situation is increased by changing land use of the region from mangrove fortress to fishpond of aqua culture since 10-15 years ago. The authors have been conducted the numerical model to perform the simulation erosion at the area as well conducted the field survey to collect the hydrodynamics data on the site.

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2. Numerical Experiment

A simulation on the region for a scale of 10 years (2002-2011) of longshore sediment transport and shoreline change were simulated by GENESIS with wave input based on hindcasting process from wind data. Fig. 1 shows shoreline position at initial -2002 (red line) and reference -2011 (blue line). According to its historical of Pondok-bali, the beach had two parallel groins (length of 150 m each) which installed at 2001.

Fig. 1 Shoreline position of Pondok bali at 2002(-red) and 2011 (-blue)

With some numerical experiments by using GENESIS we observed the numerical result after calibrated with reference data as shown Fig.2. By the comparison between initial shoreline and final shoreline based on GENESIS computation, we found that the dominant longshore sediment transport comes from east-wind monsoon season, it becomes a major contribution for major retreat shoreline occurred at west part of Pondok bali's groin (shoreline were retreat around 200-300 m).

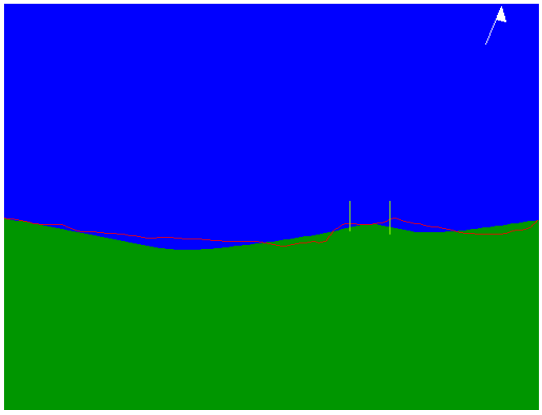

Fig. 2 GENESIS result of Pondok bali for 10 years after 2002

3. Analysis of sediment current

Hypothetic rip current fields were estimated occurred on Pondok-bali beach that circulated at between of two groins. This hypothetic were arise based on stabilization shoreline profile calculation of sedimentation response for one straight perpendicular groin installed after reach full position. Fig. 3 shows accumulated sediment response of 2 years (blue-line) and 5 years (red-line) after the groins installed on the Pondok-bali.

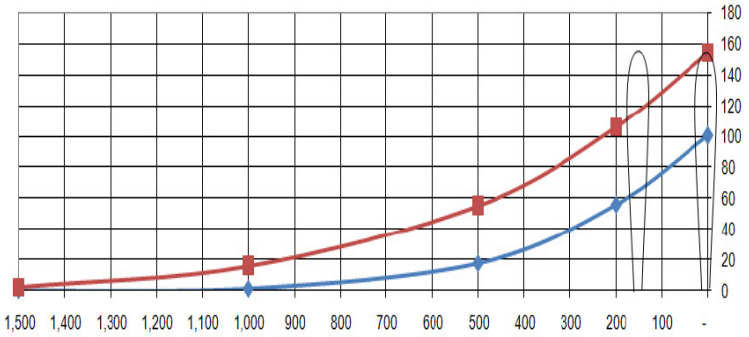

Fig. 3 Sediment response after groin were installed

This accumulation were predicted as a stabilization of Pondok-bali for 5 years after constructing of the groin, and then after reaching the tip of groin, the sediment were eroded by the rip-current due to energy dissipation at aleft groin because of wave incident almost perpendicular to shoreline (Fig. 4). This current were predicted as one contribution of retreating of Pondok-bali beach and dectructing of groin after 2006

Fig. 4 Rip current formation at the inner of groins

4. Current observation and measurement

To prove the existing of rip current, in August 2014 (this period were included as East wind monsoon season) we conducted a 24 hourly continuous current measurement by using ACM (Acoustic Current Meter) at north east of the left groin, The location of installed ACM shown at Fig. 5.

Fig. 5 Location of ACM station were installed

According the observation result, the current (combination of tidal and wave generated) were exist observed at location, it comes from arbitrary direction with some specific arrow which direct to North West that indicated as the rip current occurred at offshore of the groins (Fig. 6).

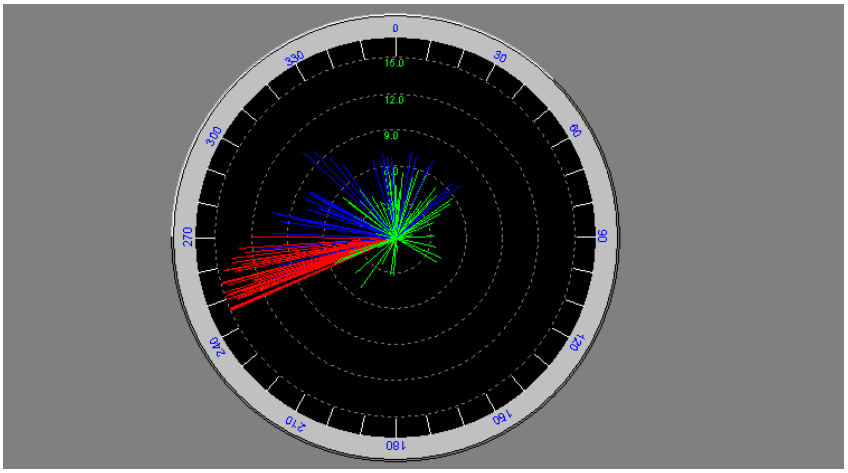

Fig. 6 24-h current distribution at August, 14-15th, 2014

5. Concluding Remarks

The wave action has significant role for shoreline dramatically change for 2011 comparing with initial shoreline at 2002. After groin installed in 2002 the stabilization of sediment response only achieved at first 5 years, and eroded after 2007, it were predicted due to the existing of rip current and environment change factors including inundation of sea water level rise after mangrove fortress at that location transform to fish-pond. All of these stories have the contributions to the retreat of Pondok-bali beach and the destruction of its parallel groins.

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